

# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

|  |   |   |
|--|---|---|
| Applicant's or agent's file reference<br><b>213</b>  | <b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) |   |
| International application No.<br><b>PCT/KR 2004/000745</b>   | International filing date ( <i>day/month/year</i> )<br><b>31 March 2004 (31.03.2004)</b>                                      | Priority Date ( <i>day/month/year</i> )<br><b>2 April 2003 (02.04.2003)</b> |
| International Patent Classification (IPC) or national classification and IPC<br><br><b>IPC<sup>7</sup>: B82B 3/00, C01B 31/02, D01F 9/12</b> |   |   |
| Applicant<br><b>KOREA RESEARCH INSTITUTE OF CHEMICAL TECHNOLOGY</b>  |   |   |

|    |   |
|----|---|
| 1. | This international preliminary examination report has been prepared by this International Preliminary Examination Authority and is transmitted to the applicant according to Article 36.  |
| 2. | <p>This REPORT consists of a total of <u>  4  </u> sheets, including this cover sheet.</p> <p><input type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of <u>          </u> sheets.</p>   |
| 3. | <p>This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> <li>I.      <input checked="" type="checkbox"/> Basis of the opinion</li> <li>II.     <input type="checkbox"/> Priority</li> <li>III.    <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</li> <li>IV.    <input type="checkbox"/> Lack of unity of invention</li> <li>V.     <input checked="" type="checkbox"/> Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li> <li>VI.    <input type="checkbox"/> Certain documents cited</li> <li>VII.   <input type="checkbox"/> Certain defects in the international application</li> <li>VIII. <input type="checkbox"/> Certain observations on the international application</li> </ul> |

|   |   |
|---|---|
| Date of submission of the demand<br><br><b>28.10.2004</b>   | Date of completion of this report<br><br><b>24 August 2005 (24.08.2005)</b> |
| Name and mailing address of the IPEA/AT<br>Austrian Patent Office<br>Dresdner Straße 87<br>A-1200 Vienna<br>Facsimile No. 1/53424/200 | Authorized officer<br><br><b>FUSSY S.</b><br><br>Telephone No. 1/53424/328  |

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.  
PCT/KR 2004/000745

## V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

### 1. Statement

Novelty (N)

Claims 1-10

YES

Claims ----

NO

Inventive step (IS)

Claims 1-10

YES

Claims ----

NO

Industrial applicability (IA)

Claims 1-10

YES

Claims ----

NO

### Citations and explanations (Rule 70.7)

The following documents have been cited in the Search Report:

D1: WO 2003/022739 A2

D2: WO 2002/076887 A2

Both documents represent the prior art with regard to the subject-matter of the independent claim 1 of the present application and show methods for producing nanotubes or nanoparticles comprising the steps of providing a hydrocarbon liquid containing metal catalyst nanoparticles as an effective carbon source and providing energy input.

D1 discloses a method for producing fullerenes, nanotubes or nanoparticles, said method comprising providing a hydrocarbon liquid as an effective carbon source and providing energy input, such that said hydrocarbon liquid produces acetylene, ethylene, methane or carbon monoxide. The cooling means consist of a cavity wall in the wall of the chamber through which a coolant is circulated. Adding soluble organometallic compounds to the liquids, like Fe-, Co- and Ni-naphtenates in toluene solutions, allows increasing yields of graphite nanofibers (GNFs) due to the simultaneous production of Fe, Co and Ni nanoclusters which catalyze GNFs' growth.

However, no method for preparing carbon nanotubes from a liquid phased carbon source comprising the steps of heating and pressurizing said carbon source to the range of critical temperature and pressure as characterized in claim 1 of the present application is disclosed in D1.

D2 shows a process for synthesis of nanotubes comprising the steps of laser ablating a bulk metal catalyst within a hydrocarbon solution to produce a feedstock containing metal catalyst nanoparticles, atomizing the feedstock to form a feedstock aerosol, and heating the feedstock aerosol to form nanotubes. The preparation of a nanotube feedstock solution comprises the steps of laser ablating a bulk metal catalyst within a hydrocarbon

**Supplemental Box**

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Box V (page 1)

solution to produce metal catalyst nanoparticles, and adding a stabilizer to the hydrocarbon solution. As the feedstock aerosol falls by gravity and by the inert gas flow through the furnace, the nanotubes form. The nanotubes so formed are collected in a collector by condensation when cooled by a coolant.

Again, no method for preparing carbon nanotubes from a liquid phased carbon source comprising the steps of heating and pressurizing said carbon source to the range of critical temperature and pressure as characterized in claim 1 of the present application is disclosed in D2.

The remaining claims 2-10 of the present application specify preferred embodiments of the subject-matter of the independent claim 1.

Therefore, the invention described in the application appears to be novel, involving an inventive step and capable of industrial application.